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(54) Means for Providing on a Lathe a Gear Change from a Set High Speed Ratio to a Set Low Speed Ratio

(57) A pivotable carrier 10 carries gears which can, in one pivot position, provide a higher speed ratio and, in another pivot position, provide a lower speed ratio between the head stock spindle gear (54) of a lathe and the lead screw gear (34) so that the lathe can be changed from a set screw cutting operation to a set turning operation and vice versa by one simple operation.

In an intermediate position of the carrier the lead screw can be operated manually when the spindle of the lathe is rotating.

Figure 2 shows only one pivot position of carrier 10. In the other pivot position a gear (35) on the same shaft as gear 34 is brought into engagement with a gear (43) mounted on stub 21, which drives gear 54 via a gear (41) mounted on pin 19 and gear 30 (see Figure 3 (not shown)), idler 12 being disengaged from gear 34.

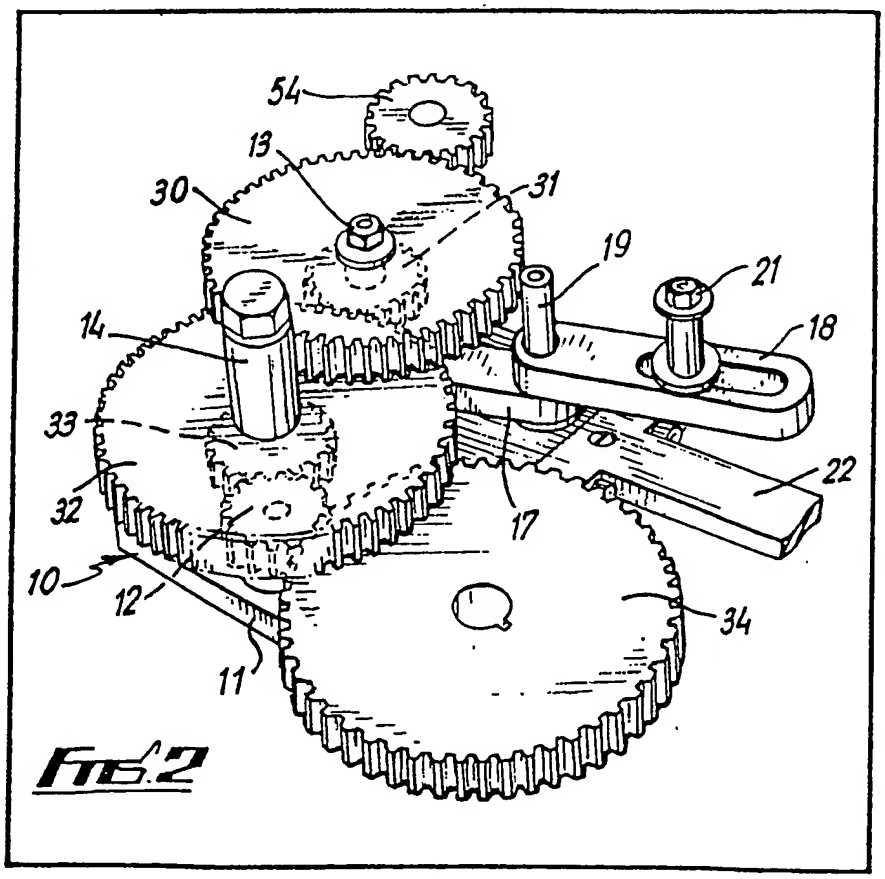

FIG.2

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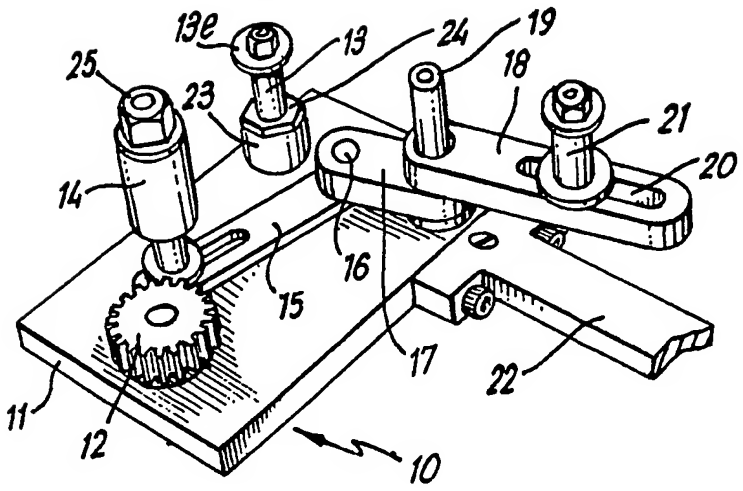
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10

FIG.1

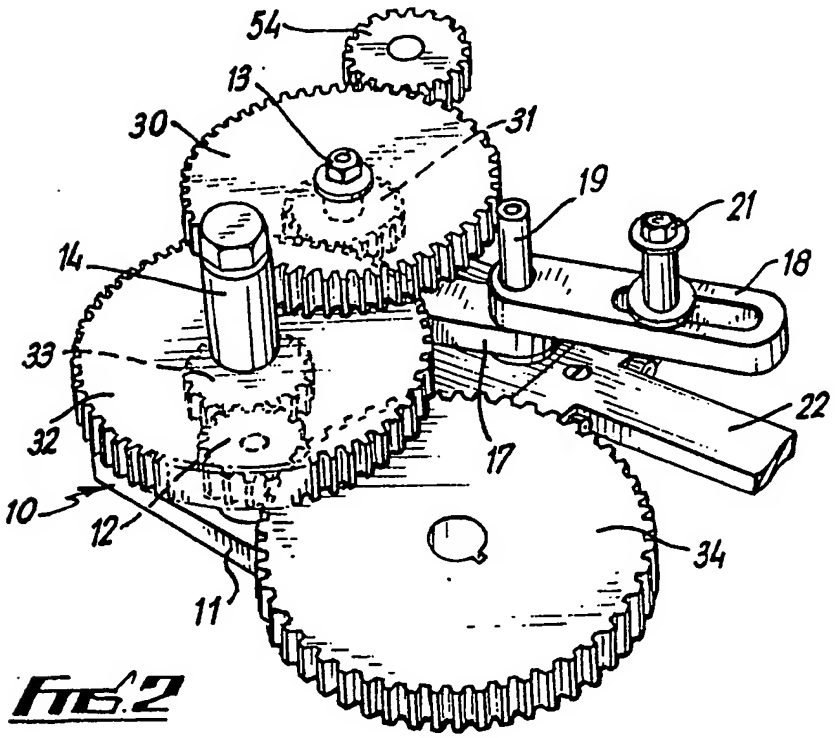
54
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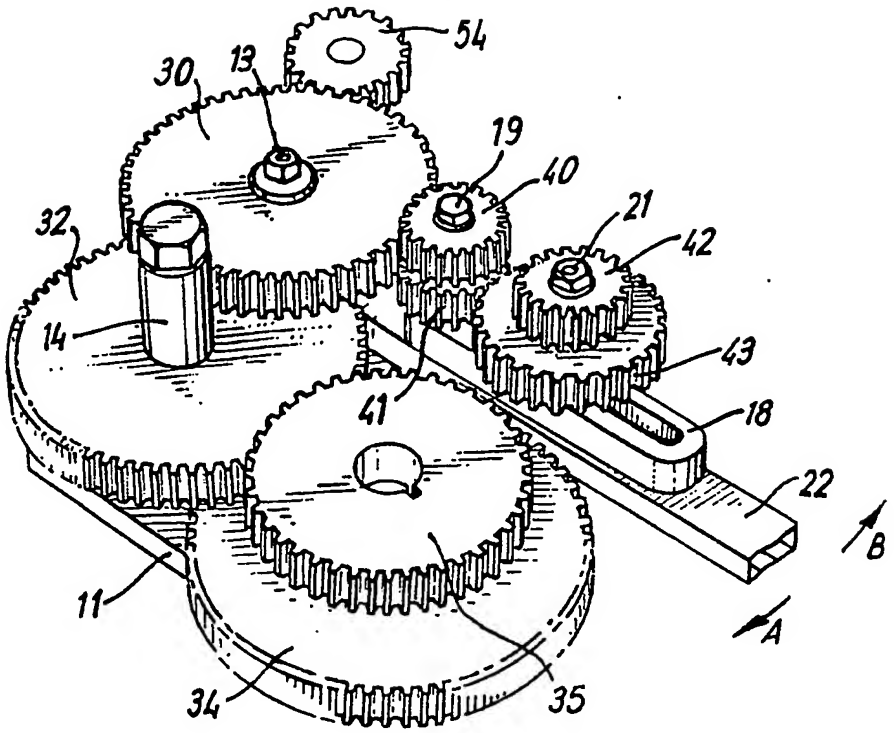
FIG.2


54
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43
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B
A
11
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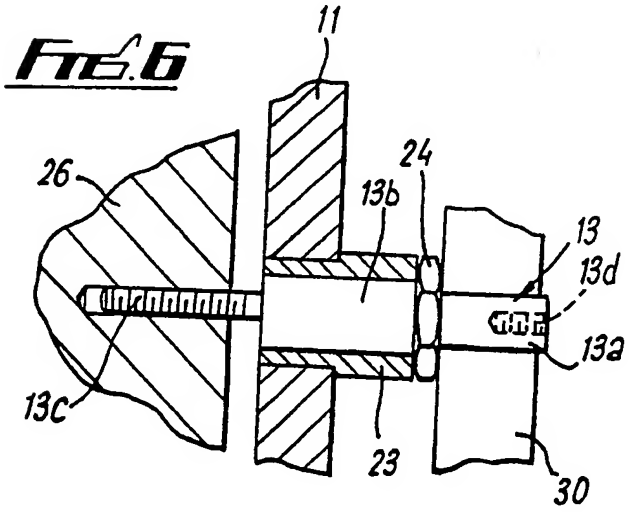
35

FIG.3

FIG.6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26
24
13b
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13d
13a
13c
23
30

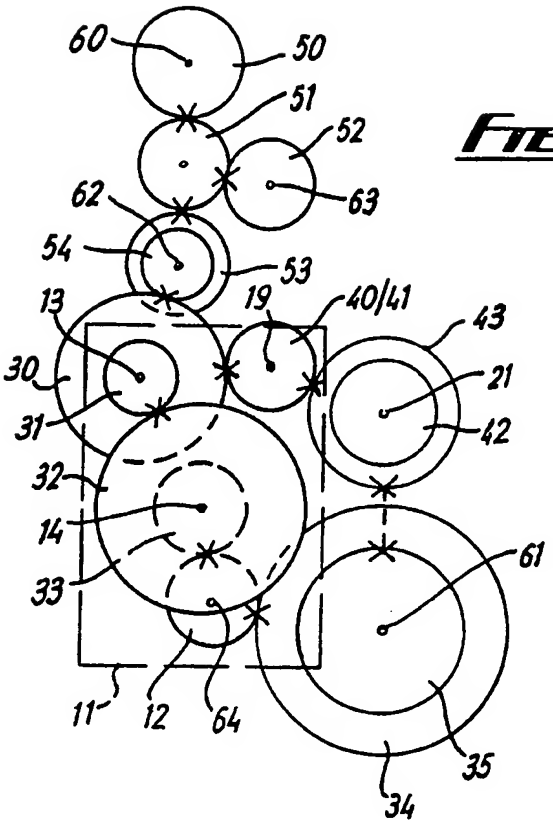
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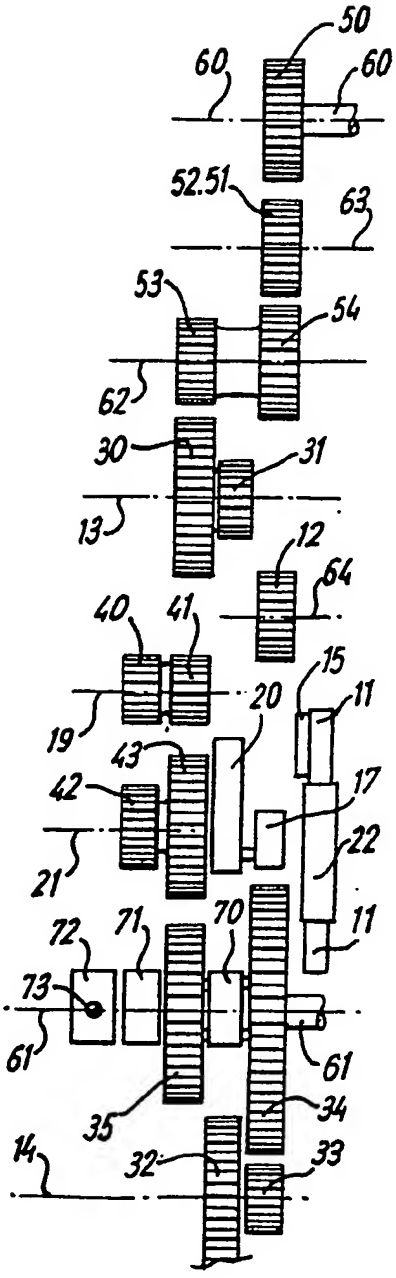
FIG.4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43
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72
71
70
73
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35
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14
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33

FIG.5

SPECIFICATION

Means for Providing on a Lathe a Gear Change from a Set High Speed Ratio to a Set Low Speed Ratio

This invention relate to lathes.

The invention is concerned with devices for changing the speed ratio between the head stock spindle gear and the lead screw gear of a lathe. The invention is particularly concerned with simple general purpose lathes having a manually changeable gear train between the above-stated gears. In one well known such lathe typically over 30 gear ratios can be set up whilst only using fourteen change gears and a slotted quadrant. However, the operations involved for most gear ratio changes are lengthy and tedious.

With this problem in mind it has already been proposed to provide, as a fittable accessory, a quick change gear box in which the most complex operation for any gear ratio change is to operate a selector, remove a link, reverse a gear and replace the link. However, such a gear box fails to satisfy the need for a rapid effortless gear change from a set high speed ratio (such as required for thread cutting) to a set low speed ratio (such as required for turning a surface of high finish). This is a common need and can be called for frequently in many operations involving, for example, alternate turning and thread-cutting operations.

The present invention satisfies this need and a preferred from provides the additional facility of easily breaking the gear train so that the lead screw of the lathe can be operated manually even when the spindle of the lathe is rotating.

The present invention comprises means for providing, on a lathe, a gear change from a set high speed ratio to a set low speed ratio; said means comprising a movable gear carrier carrying gears which can be interposed as two chains between a headstock spindle gear and a lead screw gear on the lathe so that in one position of the carrier a higher speed ratio is set up through one of said two chains and in the other position a lower speed ratio is set up through the other of said two chains from the head stock spindle gear to the lead screw gear so that the lathe can be changed from a set thread cutting operation to a set turning operation by one movement operation of the carrier and *vice versa*.

One well known form of lathe has a train of gears consisting of a head stock spindle gear, tumbler reverse gears, driver gear, 1st stud gear, 2nd stud gear and lead screw gear with the last four gears changeable to set up various speed ratios; the first and second stud gears being carried in slots in a change-gear quadrant.

Such a lathe is modified in accordance with the present invention by pivoting a pivotable gear carrier on a chosen centre of the lathe body and removing the change-gear quadrant. The carrier itself has gears which, in one pivoted position of the carrier, complete a set high speed ratio chain and, in another pivoted position, complete a set low speed ratio chain between head stock spindle gear and the lead screw gear. Preferably a neutral pivoted position exists between the two above-stated positions in which both chains are broken.

The gear carrier has demountable gears and a slotted link whereby the high speed ratio chain can be re-set.

The invention will now be described further with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a gear carrier according to the present invention;

Fig. 2 is a view as Fig. 1 but showing the gears involved in the speed reduction chain;

Fig. 3 is a view as Fig. 1 but showing the gears involved in both chains;

Fig. 4 is a gear engagement diagram;

Fig. 5 is a gear level diagram; and

Fig. 6 is a detail of the carrier of Fig. 1.

In Fig. 1 there is shown a pivotable gear carrier 10 comprising a plate 11, an idler gear 12, a first stub 13, a second stub 14 clampable on to a first arm 15 pivoted at a pin 16 on a second arm 17 which is integral with a third arm 18. Arms 17 and 18 comprise a crank pivoted on a pin 19. The arm 18 has a slot 20 in which an adjustable stub 21 can be moved and clamped. The plate has an operating lever 22.

The stub 13 is mounted rotatable in a boss 23 which is secured in the plate 11 (see also Fig. 6). The stub includes a gear carrying part 13*a*, a boss engaging part 13*b*, a threaded part 13*c* and a hexagon 24. The stub 13 is shown screwed into a lathe body 26 and the plate 11 and the boss 23 are pivotable on the part 13*b*. The part 13*a* has an internal thread 13*d* so that a gear retainer 13*e* (Fig. 1) can be fitted. When the stub 13 is screwed to lathe body the lever 22 lies at the front of the lathe and is readily accessible to the left hand of the lathe operator.

The stub 14 has a hexagonal crown 25 and serves to lock arm 15 and hence 17 and 18 when correct meshing of gears 35 and 43 (Fig. 3) has been achieved.

In Fig. 2, the carrier 10 is shown equipped with a compound gear 30/31 on the stub 13 and a compound gear 32/33 on the stub 14. A first lead screw spindle gear 34 and a driver gear 54 (which are not mounted on the carrier) are also shown. Gear 34 is keyed to the lead screw spindle of the lathe with a second lead screw spindle gear 35 (Fig. 3) but the gear 35 is not shown on Fig. 2 as it is not a part of the lower speed ratio gear train being described.

The gear train set up is 54 meshing with 30; 31 driven compounded with 30; 31 meshing with 32; 33 driven compounded with 32; 33 meshing with 12 (to give the correct direction of rotation at the end of the chain); and 12 meshing with gear 34. The speed reduction through the chain is typically such that the lead screw spindle runs at 1/43x the head stock speed.

In Fig. 3 the setting up of a higher speed ratio gear train is illustrated. The pin 19 is shown carrying a double gear 40/41, the gear 41 engaging the gear 30 and a gear 43 on stub 21. A

gear 42 rotates with gear 43 but gears 40 and 42 do not feature in the presently described train. They serve as spacers. Gear 43 is engageable, but is shown disengaged, with the second lead screw spindle gear 35. The higher speed ratio is determined by the ratio of number of teeth on gear 54 to number of teeth on gear 35 regardless of the number of teeth on gears 30, 41 and 43 as there are no compound gears in the train.

To engage the higher speed ratio train the lever 22 is moved in the direction of the arrow A (clockwise). Gear 12 ceases to drive the first lead screw spindle gear 34, and hence breaks the lower speed ratio chain, and brings the gear 43 into mesh with gear 35 to set up the higher speed ratio train.

The lever 22 has an intermediate position in which no drive is made to the lead screw spindle. In this position the lead screw of the lathe can be manipulated by hand. When the lever 22 is moved in the direction of arrow B (anti-clockwise) the lower speed ratio chain is set up. This is shown in Figs. 2 and 4.

In Fig. 4, the plate 11, shown in dash outline, is pivoted to a position on the stub 13 so that the lower speed gear train is set up to the gear 34 by way of gear 30/31 with gear 31 meshing with gear 32/33, with gear 33 meshing with gear 12, with gear 12 meshing with gear 34. (The 'X' marking indicates gear meshing).

The fast speed gear train is broken at the "X—X" line between gear 43 and gear 35/34.

For fast speed operation the plate 11 is pivoted clockwise. The first effect of this is to break the 'X' between gear 12 and 34. The next effect is to bring gear 43 into mesh with gear 35. The fast speed gear train is then set up to the lead screw gear by way of gear 54 meshing with gear 30 meshing with gear 41 of gear 40/41, with gear 41 meshing with gear 42/43, and with gear 43 meshing with gear 35 on the lead screw.

Fig. 4 also shows the head stock spindle gear 50, tumbler reverse gears 51 and 52 and driver gears 53/54 with gear 54 meshing with gear 30 on the plate 11.

Axes 60, 61, 63 and 64 are shown in Fig. 4 to relate with axes in Fig. 5. Axis 60 is the head stock spindle gear axis and axis 61 is the lead screw gear axis. Axis 63 is that of one of the tumbler reverse gears and axis 64 is that of the idler gear 12.

In Fig. 5 no complete attempt has been made to locate the gears exactly in the vertical direction. However their correct planes (levels) of operation are indicated. Toothed gears are symbolically represented by horizontal lining. The plain "boxes" represent non-toothed components. Of those not previously mentioned are a collar 70 between gears 35 and 34 and collars 71 and 72. Collars 70 and 71 are free on the lead screw axis 61 and collar 72 is held on the lead screw 61 by a grub screw 73. Gears 35 and 34 are keyed to the lead screw axis 61.

It is a feature of the present invention that a first large group of higher speed ratios can be reset by the simple operation of replacing gear 35 with one having more or less teeth and that a second large group can be similarly reset. Change over between groups involves no more than the simple operation of interchanging the levels of gear 35 and spacer 71 and adjusting the crank 17/18 so that gear 42 engages gear 35. For example it is possible (with gear 43 engaging gear 35) to cut 8, 10, 12, 14, 16, 18, 20, 22, 24 and 26 threads per inch simply by changing the number of teeth on gear 35 to 20, 25, 30, 35, 40, 45, 50, 55, 60 and 65 respectively. This is the first large group.

It is then possible (by interchanging the levels of gear 35 and spacer 71, with gear 42 engaging gear 35) to introduce a 1:2 compound gear in the train to cut 28, 32, 36, 40, 44, 48, 52 and 60 threads per inch simply by changing the number of teeth on gear having the reference number 35 on the drawings to 35, 40, 45, 50, 55, 60 and 70 teeth respectively. This is the second large group.

These two large groups do leave the less common 9, 11, 19 and 25 threads per inch uncatered for but these can be catered for by changing gears 40 and 41 in Fig. 3 for a 20:40 compound gear with gear 40 being the 40 teeth drive gear and changing gears 42, 43 and 35 accordingly.

If 46 and 54 threads per inch are required then gear 41 becomes the drive gear with 20 teeth and gears 42, 43 and 35 are selected accordingly.

Metric pitches can be obtained by the introduction of suitable conversion gears in the high speed gear train.

Claims

1. Means for providing, on a lathe (26), a gear change from a set high speed ratio to a set low speed ratio; said means comprising a movable gear carrier (10) carrying gears which can be interposed as two chains between a head stock spindle gear (50, 54) and a lead screw gear (34, 35) on the lathe so that in one position of the carrier a higher speed ratio is set up through one of said two chains (30, 41, 40, 42, 43, 35) and in the other position a lower speed ratio is set up through the other of said two chains (30, 31, 32, 33, 12, 34) from the head stock spindle gear to the lead screw gear so that the lathe can be changed from a set thread cutting operation to a set turning operation by one movement operation of the carrier and *vice versa*.

2. Means as claimed in claim 1 having a facility so that with the gear carrier in between the two stated positions both of said two chains are broken so that the lead screw of the lathe can be operated manually when the spindle of the lathe is rotating.

3. Means as claimed in claim 1 in which one gear (35) is demountable to the changeable in size and there is a crank (17/18) whereby, on changing the sizes of said one gear (35), and adjusting the crank (17/18) to accommodate the changes of size, different high speed ratios can be set up.

4. Means as claimed in any preceding claim in which the carrier (10) is movable by pivoting under control of a lever (22) and, when mounted on a lathe, the lever is at the front of the lathe and accessible to the left hand of the lathe operator.

5. Means for providing, on a lathe, a gear change from a set high speed ratio to a set low speed ratio substantially as hereinbefore described with reference to the drawings.

6. A lathe equipped with means as claimed in any preceding claim.

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